

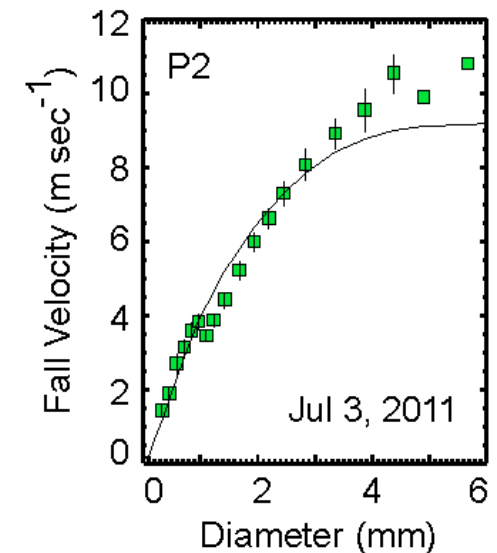
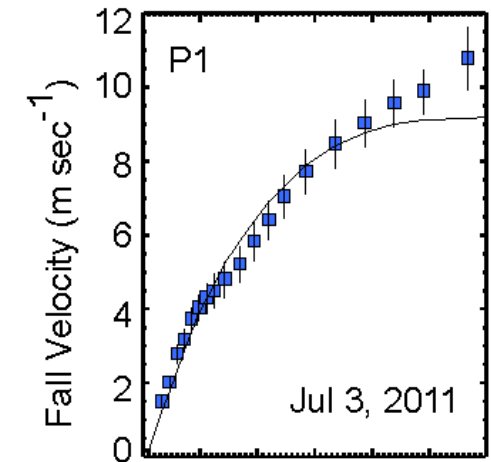
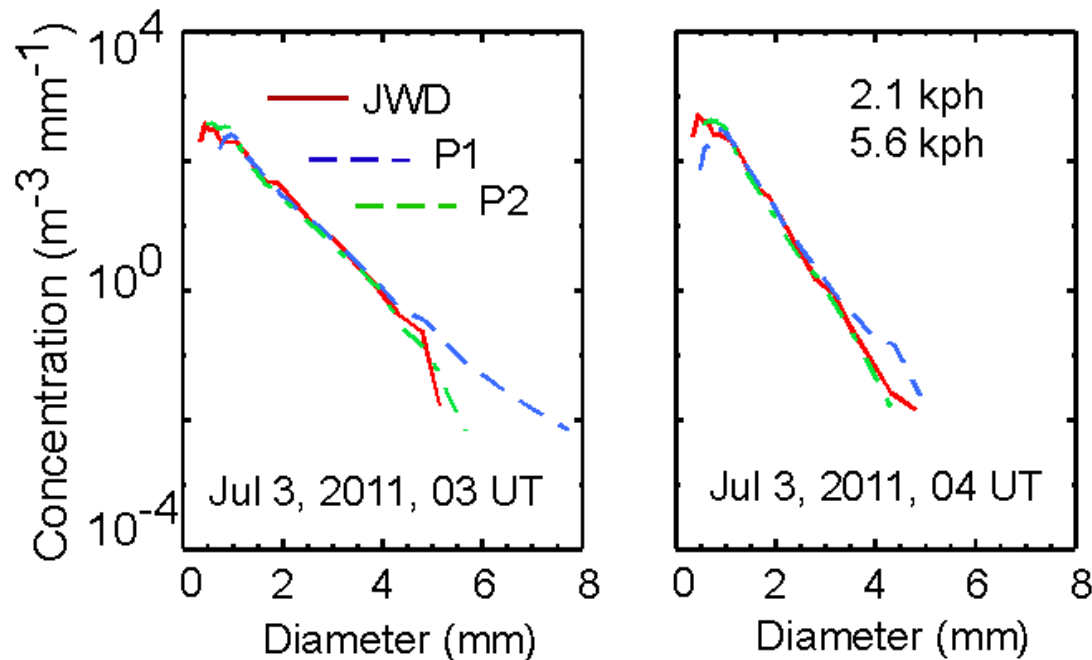


Evaluation of the New Version of the Laser-Optical Disdrometer, OTT PARSIVEL²

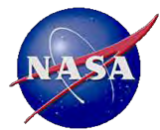


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¹Code 612, NASA/GSFC, ²JCET/UMBC, ³NASA/GSFC/WFF



One of the key objectives of the NASA's GPM mission is to retrieve the raindrop size distribution (DSD) from its dual-frequency radar measurements. PARSIVEL (PARTicle Size VELOCITY) disdrometer measures the particle size distribution directly and can be used to test the parameterized form of the DSD retrieval algorithm. This study concluded that the new version of PARSIVEL (P2) is a qualified instrument to parameterize the DSD while the old version of PARSIVEL (P1) is not.



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References:

Ali Tokay, David B. Wolff, and Walter A. Petersen, 2014: Evaluation of the New Version of the Laser-Optical Disdrometer, OTT PARSIVEL2. *Journal of the Atmospheric and Oceanic Technology*, 31, 1276–1288.

doi: <http://dx.doi.org/10.1175/JTECH-D-13-00174.1>

Data Sources: A beta version of the PARSIVEL disdrometer (P2) was operated with a collocated commercially available PARSIVEL (P1), as well as an impact-type Joss-Waldvogel disdrometer (JWD), and two tipping bucket rain gauges on the roof of building 33 at NASA Goddard Space Flight Center. The experiment period was between 28 February and August 2, 2011.

Technical Description of Figures:

Comparison of size distribution measurements: PARSIVEL measures the size and fall velocity of individual hydrometeors. Previous studies have revealed that P1 underestimates the number of drops less than 1 mm and overestimates the number of drops larger than 3 mm particularly in heavy rain. The JWD measures the size distribution of raindrops only and is used as a reference instrument. Hourly composites of the size distributions reveal that the P2 measurements are in a good agreement with JWD across all sizes. Thus it is concluded that the P2 is an improved version of P1 and the improvement can be attributed to the higher quality laser device in P2. The laser was partially inhomogeneous in P1.

Fall Velocity measurements: P1 slightly overestimates the fall speeds of small drops with respect to the terminal fall velocity of raindrops, while it overestimates the fall velocity of midsize drops (1 – 3 mm in diameter). These features were observed regardless of wind speed and event characteristics. The manufacturer attempted to correct the measurement errors in fall velocity through laboratory testing of P2. While the mean fall velocity of small drops follows the terminal fall speed in P2, there is a sharp drop off in measured fall velocity at 1 mm. The difference between the measured and terminal fall speed is 1 m s⁻¹ at this size and the difference lessens at larger sizes. The manufacturer made further attempts to correct the fall speed error with a new firmware, but this was not successful. Later, the manufacturer turned its attention to reconfigure the hardware which is expected to be available in upcoming years. Since the fall velocity is used in calculating the size distribution, terminal fall velocity rather than measured fall velocity should be used in determining the size distribution from P2 measurements.

Scientific significance, societal relevance, and relationships to future missions: PARSIVELs have been widely used during NASA Global Precipitation Measurement (GPM) mission ground validation program field campaigns and direct data observation sites. It is the most affordable commercially available disdrometer. It is robust and requires low maintenance. It is also a present weather sensor. Based on these features, PARSIVELs are the most commonly used disdrometer worldwide. Within GPM, it is used to investigate the various assumptions of spaceborne radar precipitation retrieval algorithms and spatial variability within satellite footprints. In that regard, the PARSIVEL's measurement accuracy in both size and fall velocity of hydrometeors is critical.

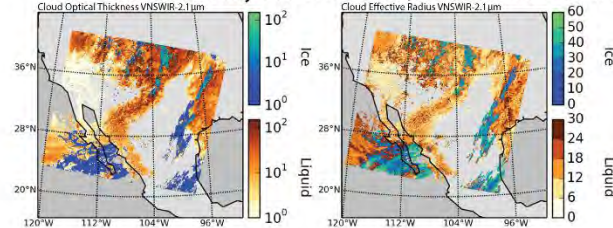


The CHIMAERA System for Universal Cloud Retrievals

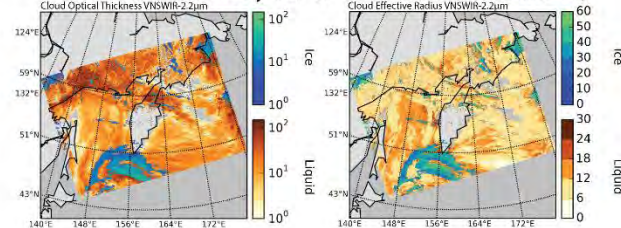
G.Wind¹, S. Platnick², K. Meyer³, N. Amarasinghe¹, T. Arnold¹, B. Marchant³, Code 613, NASA/GSFC
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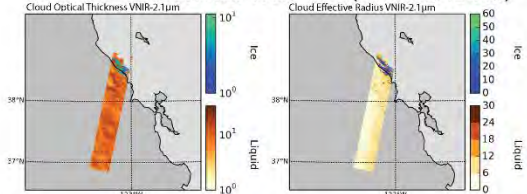
Terra MODIS 2014 day 360 17:55 UTC (1km, 500m or 250m resolution)



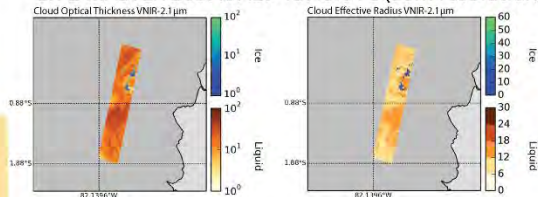
NPP VIIRS 2014 day 187 02:00 UTC (800m resolution)



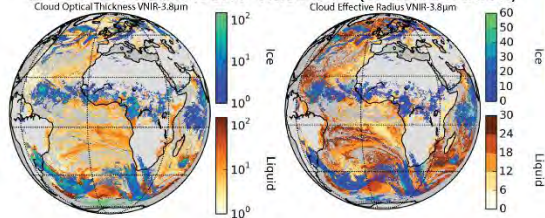
ER-2 eMAS 2013.10.23 18:55 UTC (50m resolution)



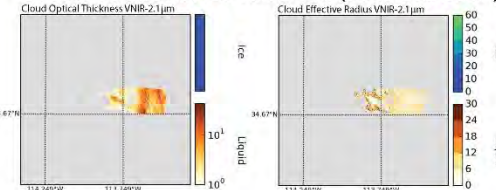
ER-2 MASTER 2007.07.29 15:40 UTC (50m resolution)



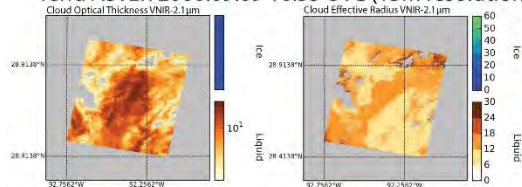
MSG SEVIRI 2009.08.17 12:00 UTC (3km resolution)



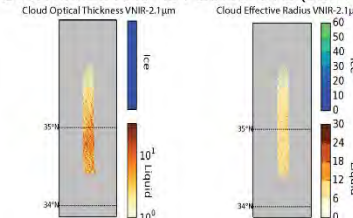
B200 AMS 2011.07.26 15:05 UTC (50m resolution)



Terra ASTER 2006.09.09 16:55 UTC (15m resolution)

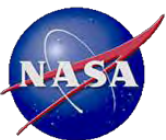


ER-2 AVIRIS 2015.01.31 20:30 UTC (50m resolution)



**Have bands?
Will retrieve!**

The CHIMAERA (Cross-platform High resolution Multi-instrument AtmosPheric Retrieval Algorithms) system allows the operational MODIS cloud optical and microphysical properties retrieval algorithm to be run on any other instrument with a minimum set of useful channels.



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References:

Platnick, S., J. Y. Li, M. D. King, H. Gerber, and P. V. Hobbs, 2001: A solar reflectance method for retrieving the optical thickness and droplet size of liquid water clouds over snow and ice surfaces. *Journal of Geophysical Research: Atmospheres*, **106**, 15185-15199.

Platnick, S., M. D. King, S. A. Ackerman, W. P. Menzel, B. A. Baum, J. C. Riedi, and R. A. Frey, 2003: The MODIS cloud products: algorithms and examples from Terra. *Geoscience and Remote Sensing, IEEE Transactions on*, 41, 459.

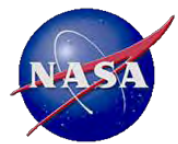
——, 2014: MODIS Cloud Optical Properties: User Guide for the Collection 6 Level-2 MOD06/MYD06 Product and Associated Level-3 Datasets. NASA.

Data Sources: Operational MOD06 product (LAADS), VIIRS_06 product (SIPS, University of Wisconsin), MAS, AMS, MASTER, AVIRIS PGE06 data (NASA ARC), SEV_06-CLD SEVIRI product (ICARE University of Lille), ASTER_06 product (NASA GSFC), AVIRIS data (DRI).

Technical Description of Figures:

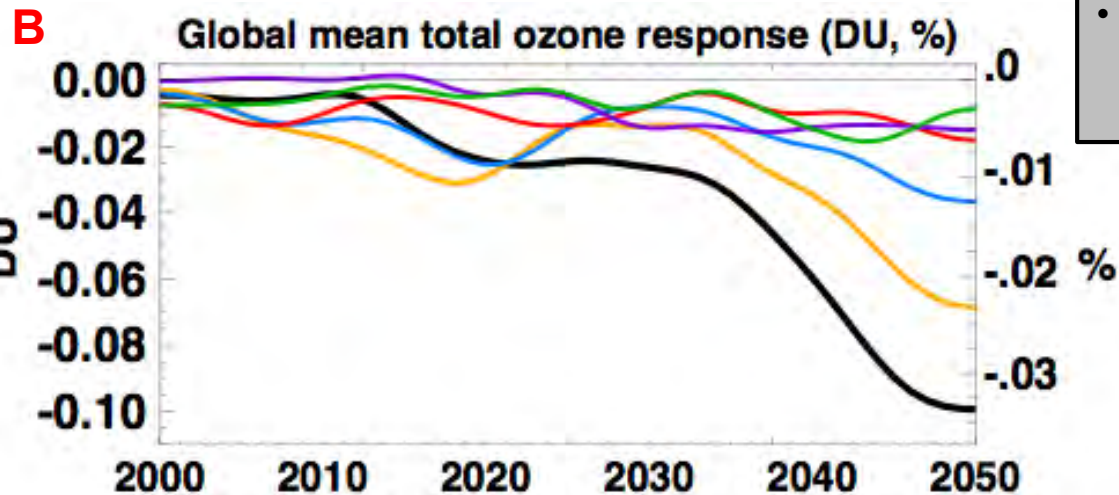
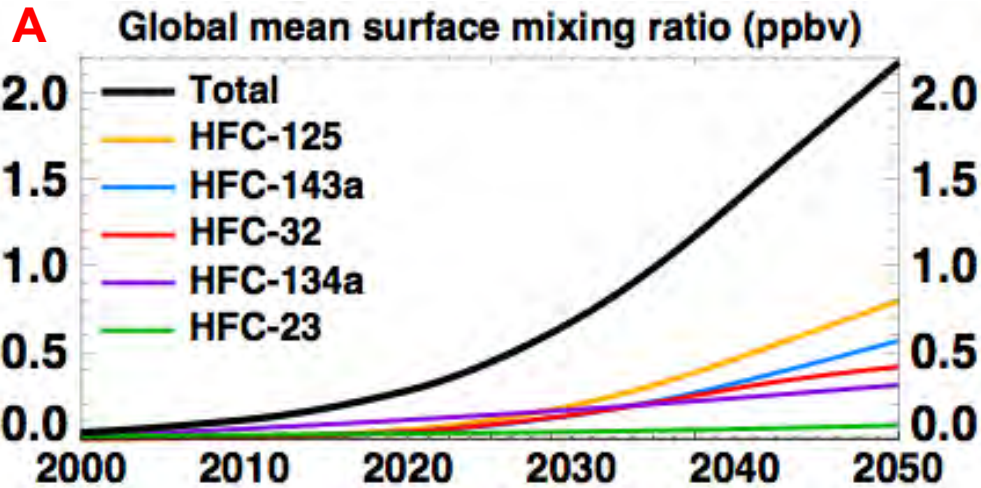
Graphic 1: This is an illustration of CHIMAERA's capabilities. All the data was produced using one unified code. A shared science core executes the retrieval once all necessary parameters have been loaded. CHIMAERA runs on any operating system and on any size machine from a laptop at a field campaign to a supercomputer as a true parallel code. CHIMAERA can be easily expanded at will to include other sensors and all output is in standard format compatible with the MOD06 product format. As an illustration of that, the individual images have been generated using a single Python visualization code applied to all images without any changes whatsoever to the code.

Scientific significance, societal relevance, and relationships to future missions: The CHIMAERA system allows us to disregard engineering as a factor when retrievals from different sensors are compared. Rather, we take advantage of the known pedigree of the operational MODIS cloud product, which has been extensively documented and validated over many years of production. As long as a sensor's data is readable and valid, CHIMAERA can perform retrievals on that sensor. CHIMAERA can be a valuable tool when data record continuity and traceability is important because there is never a question of which exact retrieval algorithm had been used. It is already being used in such capacity for MODIS-VIIRS data continuity and for validation and calibration work with airborne sensors. CHIMAERA's existence allows the MODIS group also to collaborate with many different organizations that have sensors and would like to obtain MODIS-like cloud property retrievals from them. An example of such extensive collaboration is the MSG-SEVIRI cloud product which is produced as a joint effort between NASA, NOAA, University of Lille and the ICARE data center.

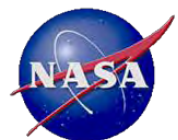


Ozone Depletion by Hydrofluorocarbons (HFCs)

Margaret Hurwitz, Eric Fleming, Feng Li & Paul Newman
Code 614, NASA/GSFC and GESTAR, Morgan State University



- Hydrofluorocarbons (HFCs) are strong radiative forcers with rapidly increasing atmospheric concentrations (**A**)
- NASA GSFC 2D model simulations show that HFCs:
 - Warm the troposphere and stratosphere
 - Enhance the Brewer–Dobson circulation
 - Are weak ozone–depleting substances (**B**)
- Planned GEOSCCM simulations will investigate the global and regional impacts of HFCs



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References:

Hurwitz, M. M., E. L. Fleming, P. A. Newman, F. Li, E. Mlawer, K. Cady-Pereira, and R. Bailey (2015), Ozone Depletion by Hydrofluorocarbons, *Geophysical Research Letters*, submitted.

Data Sources:

NASA GSFC 2D Model (updated from Fleming et al. (2011), with a new IR parameterization that includes interactive HFCs)

GEOSCCM (Feng Li et al., Impacts of Stratospheric Chemistry on Antarctic and Southern Ocean Climate Change, submitted)

Technical Description of Figures:

A Projected global mean surface mixing ratios for five HFC species (colored lines, ppbv) and their total (black line).

B Modeled global mean total ozone response (DU, %) to HFCs. The total column ozone timeseries are smoothed to emphasize the long-term ozone trends.

Scientific significance, societal relevance, and relationships to future missions:

This study is the first to quantify the impacts of HFCs in a coupled chemistry-climate model. Considering the interactions between chemistry, radiation and dynamics, HFCs have positive ozone depletion potentials (ODPs) and thus should be considered as ozone-depleting substances. While the impact of HFCs on stratospheric ozone is far weaker than that of the CFCs, halons and other substances that caused the 'ozone hole', the implication of this study is that HFCs can be regulated under existing legislation (internationally by the Montreal Protocol, and domestically by the US Environmental Protection Agency). Already, the Montreal Protocol has played an important role in protecting global climate. Restricting the future production and use of HFCs could be an important step toward mitigating significant global climate change.